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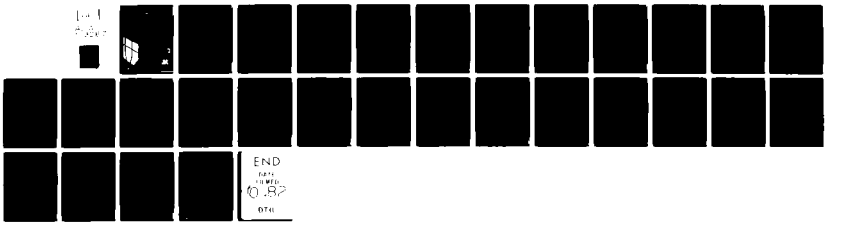

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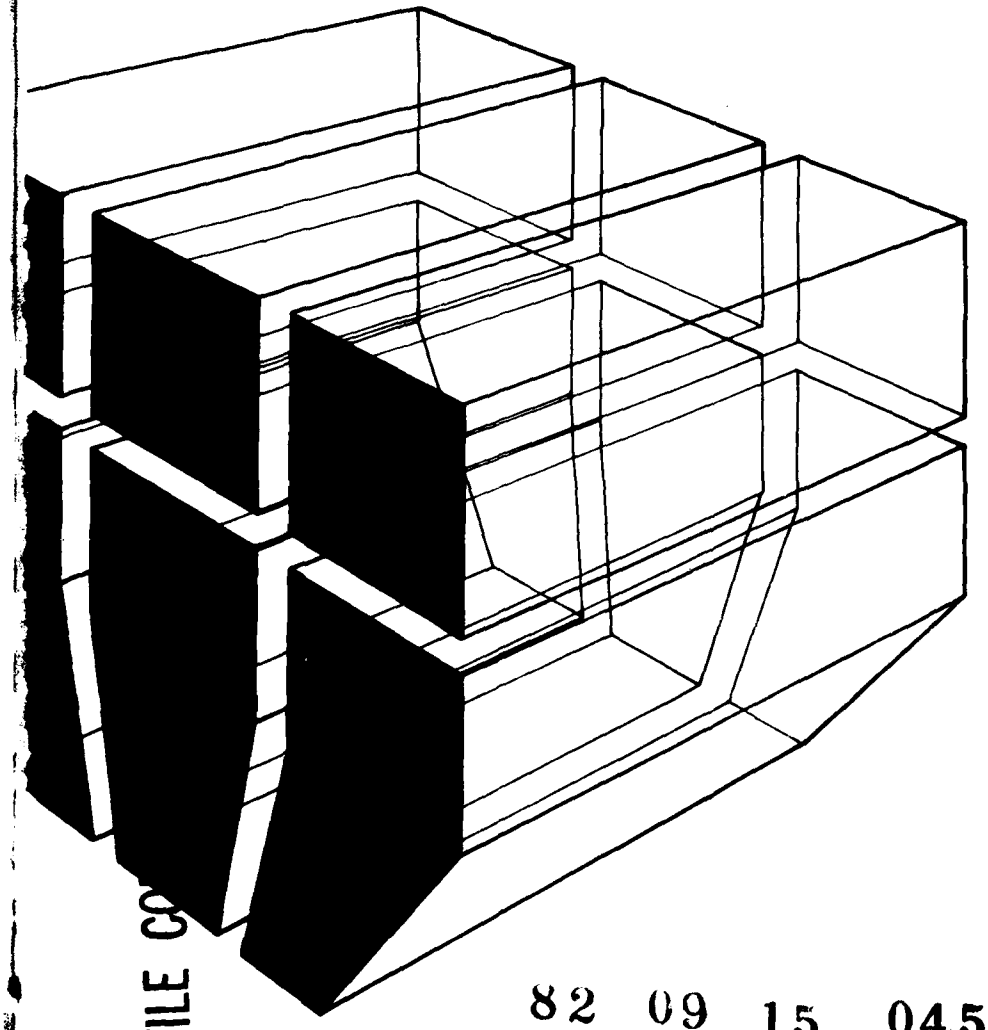
Technical Report M-320
July 1982

MILITARY INSTALLATION PAINTING PROBLEMS: SURVEY ANALYSIS AND RECOMMENDED SOLUTIONS



by
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This report has identified several of the major painting problems encountered by the Facilities Engineer offices on various Army installations. The problems were identified by analyzing the results of questionnaires sent to 14 Army installations and by visiting six installations to observe paint operations and interview personnel involved in these operations.

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Analysis of the questionnaire and site visits indicated the following: (1) installation personnel think that Federal and military specification paints are inferior to brand-name paints and that guide specifications do not apply well to all applications; (2) there are not enough paint inspectors to insure quality control of every job; (3) installations tend to accept manufacturer certification of their paints, in lieu of testing, because testing takes too long; (4) many premature paint failures result from insufficient structure and surface preparation; (5) many installations are using or plan to use siding in lieu of paint; and (6) compliance with environmental regulations causes few or no problems to the installations.

Based on an analysis of the survey results, the need for three research programs was identified: (1) development of a paint selection handbook, (2) development of more effective inspection procedures, and (3) development of a paint maintenance management system.

FOREWORD

This research was conducted for the Directorate of Military Programs, Office of the Chief of Engineers (OCE) under Project 4A762731AT41, "Military Facilities Engineering Technology"; Task E, "Theater of Operations Construction"; and Work Unit 043, "Coating and Overlay Systems for FE Facilities."

The work was performed by the Engineering and Materials Division (EM) of the U.S. Army Construction Engineering Research Laboratory (CERL). Dr. R. Quattrone is Chief of CERL-EM.

COL Louis J. Circeo is Commander and Director of CERL and Dr. L. R. Shaffer is Technical Director.

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MILITARY INSTALLATION PAINTING PROBLEMS: SURVEY ANALYSIS AND RECOMMENDED SOLUTIONS

1 INTRODUCTION

Background

Army installations throughout the United States maintain a huge inventory of equipment and housing. Each year, the Army spends millions of dollars to maintain this inventory. Painting is a significant part of facility maintenance; the Army does extensive painting on buildings, pipes, storage tanks, and all types of equipment every year. Therefore, it is important that these painting operations be as efficient and economical as possible and that any problems with the quality of the paint products, equipment, procedures, and specifications be solved.

Facility Engineer (FE) offices often contact the U.S. Army Construction Engineering Research Laboratory's [CERL] paint laboratory regarding their painting operations. Initial contacts with FE offices usually concern the paint specification compliance testing program. However, the FEs often contact CERL for answers to questions on topics such as coating selection and performance, air pollution and application requirements, inspection techniques, proprietary products, and standard practices used by the painting industry. The number of questions has increased rapidly over the past several years. In 1981, more than 150 calls were answered.

Because of this large number of phone inquiries, in FY81 CERL started a paint research and development (R&D) program to help the FE solve maintenance painting problems and use limited funds more effectively. One aspect of this R&D program was to determine the FE's major painting problems. Such information would be useful for helping the Army determine what types of research and development would solve these problems.

Objective

The objectives of this study were to identify the Army's major paint-related problems and to identify research and development programs to solve these problems.

Approach

Telephone inquiries received from military bases and information from a 1977 base survey to determine the magnitude of premature paint failures were analyzed. Based on these analyses, a two-phased survey was initiated. First, questionnaires were sent to personnel involved with the management, planning, and inspection of painting operations at 14 Army installations. Second, six posts were visited to observe paint problems and painting operations and to interview installation personnel involved in these operations. Survey responses were compiled and analyzed.

Mode of Technology Transfer

It is recommended that the information in this report be disseminated through an Engineer Technical Note.

2 INITIAL DATA ANALYSIS

The phone calls CERL has received over the past few years from military installations about paint-related topics are categorized in Table 1.

The high percentage of calls about coating selection and failure analysis suggests that this information is not readily available to FE and military construction offices. Most of the other questions are answered in TM 5-618, EM 1110-2-3400, CEGS-09910, CW-09940, and RPMA.[1]

In 1977, the exterior wood surfaces of World War II-era buildings[2] were surveyed at 53 FORSCOM, TRADOC, and DARCOM installations to determine the magnitude of premature paint failures. The survey investigated (1) the magnitude of repainting (number of buildings, area, cost) and (2) the estimated magnitude of premature paint failure.

Researchers attempted to correlate the percentage of structures at each post that showed premature paint failure with various environmental parameters. Appendix A summarizes these data. No clear correlation was found between premature paint failures and average temperature, relative humidity, dewpoint, or sulfur

[1] *Paints and Protective Coatings*, TM 5-618 (Departments of the Army, Navy, and Air Force, June 1981); *Painting: New Construction and Maintenance*, EM 1110-2-3400 (Office of the Chief of Engineers, 20 June 1980); *Painting, General*, CEGS-09910 (U.S. Army Corps of Engineers, January 1978); *Painting: Hydraulic Structures and Appurtenant Works*, CW-09940 (DA, August 1981); *RPMA Guide Specifications 50200*, RPMA Topic 17, Interior Painting, 18, Water Storage Tank Painting, and 19, Exterior Painting (DA, May 1977).

Table 1
Summary of Telephone Consultations

Topic	% of Calls
Coating Selection	43
Failure Analysis	28
Coating Application	10
Coating Compatibility	6
Air Pollution Regulations	5
Surface Preparation	3
Storage of Paints	3
Proprietary Products	2
	100

oxide emission density. However, the data did suggest that higher precipitation contributes to premature paint failure. Figure A-1 of Appendix A plots the percentage of structures exhibiting premature paint failure vs. average annual precipitation. There is a much higher incidence of premature paint failure in regions where the average annual precipitation exceeds 35 in. (889 mm). In regions where the average precipitation is less than 35 in. (889 mm), only three installations out of 11 showed more than a 20 percent failure rate. However, in regions where the average precipitation is more than 35 in. (889 mm), 24 out of 30 showed more than a 20 percent failure rate.

3 SURVEY QUESTIONNAIRES

Questionnaires were sent to 14 Army bases to get answers to general questions regarding satisfaction or problems with painting guidance, painting materials, inspection, contractors, and other painting-related topics. Three individuals at each base were each to complete a questionnaire: (a) the Chief of Engineering Plans and Services, (b) the engineer or architect involved with developing painting contracts, and (c) the paint inspector. Survey questionnaires were also filled out at five of the installations included in the site survey.

Most of the questions could be answered "yes" or "no"; however, personal comments were encouraged. Appendix B provides a copy of the questionnaire and summarizes both the yes/no and narrative responses. Where more than one person was asked the same question, the answers have been coded to distinguish who was responding: A–Chief of Engineering; B–Engineer or Architect; and C–Inspector. Responses to yes/no questions are given in percentage of respondents for each job classification and include the percentage of those who did not respond (NR) to the question. For each narrative response, Appendix B gives the total number of persons responding and the number of persons expressing each viewpoint.

The following sections discuss the survey results.

Guide Specifications and Contracts

Most people seem satisfied with the format and writing style of the guide specifications. All of the engineer/architects said that the guide specs are easy to use as they are or with minor changes. Six of 10 engineer/architects and 11 of 13 branch chiefs feel that the guide specifications are not too complicated. Both groups think that the guide specs are strong enough to force compliance.

One out of four of the office chiefs said they lack enough guidance to properly determine what paint or paint system to specify for a particular application. One reason for dissatisfaction with the guide specs is that they do not apply to maintenance painting jobs; however, this may indicate that the most appropriate guide specs are not being used. All of the engineer/architects said that they use CEGS-09910, which applies to new construction. Only one in 10 listed the Real Property Maintenance Activities Guide Specification (RPMA) on painting, which applies to maintenance and repair work. Together, these publications are designed to cover all aspects of both new construction and maintenance painting.

Two publications can supplement the guide specification: EM 1110-2-3400 and TM 5-618. Both give a general overview of the selection and use of coatings.

Fewer than half of the engineer/architects are familiar with the deficiency checklist in the RPMA Guide Specification on painting; of these, only two actually use it. This checklist can be valuable for determining the overall maintenance and repair work that a building requires.

Many survey respondents were dissatisfied with the quality of the Federal specification paints listed in CEGS-09910. Some people suggested upgrading the quality of these paints; others suggested eliminating references to Federal specification numbers altogether

[2] *Paint Survey and Testing Paint on Siding, World War II Mobilization-Type Buildings*, ETN 78-5 (Office of the Chief of Engineers, 2 February 1978).

and instead, including guidelines for selecting good-quality commercial products.

Seven of 10 installations include performance guarantees in their painting contracts. Nearly all respondents believe their contracting officers stand behind and enforce the contracts for painting and the guide specification requirements within the contracts.

Contractors

The use of in-house labor for painting is decreasing and will probably continue to decrease because of cutbacks in government personnel. Contractors do most of the painting at Army installations. Generally, the respondents who deal with contractors consider them to be reputable. About three out of 10 feel that the contractors do just enough to get by, while seven out of 10 feel the contractors try to do a good job. Nine out of 10 believe the contractors have good enough surface preparation and application equipment to do a proper job.

Several installations reported specific problems with work performed by contractors. Three out of 10 said that surface preparation is not always done in accordance with contract requirements. Another three out of 10 reported problems with mixing and thinning of paints; most of these problems occurred because the contractor overthinned the paint. Others reported inadequate mixing of paints which had been stored for a long time. Nearly half the respondents reported that coats of paint were too thin or omitted completely. For example, sometimes the contractor will try to apply a very thin first coat. Such problems can be determined through careful observation by the paint inspector.

Contracts at nine out of 10 posts specify the use of protective measures, such as masking tape, a tarp, and vinyl cover. The paint inspectors report that eight out of 10 contractors sufficiently protect work areas. Cleanup is usually satisfactory before the contractor leaves, but often only at the insistence of the paint inspector.

In summary, the general impression of overall contractor performance is high; however, an analysis of the specific contractor-related questions indicates that the contractors often do not comply with the contracts' details. Such noncompliance problems are common.

In-House Vs Out-of-House Painting

The average post has three or four painters who are permanent government employees. The use of in-house painters is governed primarily by the size of the job; i.e., in-house personnel mainly do small jobs, such as latrines, or touch-up and trim work. Other criteria include workload, time required for job completion, cost, and job priority.

Materials

The contractor supplies most of the paint at the majority of posts; in fact, about 85 percent have almost all of their paints supplied by the contractor. Eight out of 10 respondents prefer this method; many believe that this helps the contract run more efficiently. Also, this method eliminates the need to store government-furnished paint provided by the General Services Administration (GSA). Others complain GSA paint delivery is not timely. About 40 percent of the posts use some government specification paints supplied by GSA.

Half the respondents feel that GSA does not provide timely delivery, and half find the condition of the paint unacceptable. None have GSA paints tested. It is generally assumed that GSA maintains its own quality control and that these paints will conform to specifications. More than half the respondents feel that GSA paints do not perform as expected.

About 60 percent of the installations obtain government spec paints through local procurement. All find that these paints are easy to obtain and that their condition is acceptable; most find that paints procured this way meet expectations.

About half of the posts have used off-the-shelf proprietary products. Nine out of 10 feel that the paint quality is as expected. It is harder to specify shelf products in a contract. Some specify paints by brand name "or equal." Others develop technical provisions from manufacturers' data sheets and put these in the contract.

Although many posts are happy with off-the-shelf paints, some problems were reported. Some say it is hard to justify sole-source procurement of brand-name products. Others say it is hard to prove that one product is equal to another. Although brand-name products present some special problems, most people who use them feel that they perform as expected.

In summary, government specification paints procured from GSA are thought to perform poorly. Proprietary off-the-shelf paints and government specification paints procured locally seem to perform as expected, though specifying off-the-shelf paints is often a major problem.

Paint Testing and Manufacturer's Certification

CEGS-09910 recommends that a laboratory test any batch of paint of more than 25 gal for conformance to specifications. This testing should be done as a quality control measure before the paint is applied. These survey results indicate that perhaps no more than 10 percent of the posts routinely test the paint they buy. About 80 percent of the posts surveyed have some of their paint tested by a lab for conformance to specifications; however, many have the paint tested only after it has been applied and a problem is observed. Others test the paint only when they are unfamiliar with or suspicious of the manufacturer or contractor. Sixty percent of the posts test 10 percent or less of their paint.

There are other problems with paint testing. It is hard to test commercial paints because they are not formulated to meet government specifications. Also, most contractors start applying the paint within a few days after it is received; thus, there is no time to test a sample and get the results. Most respondents say they receive test results promptly enough to be worthwhile; however, few require that test results be received before the painting begins. There were no reports of contractors hindering the taking of paint samples.

Three out of four posts have their paint tested at a government laboratory. The majority of this governmental testing is performed by one of seven Corps of Engineers labs which are equipped to do paint testing. The overall cost per sample ranges from $50 to $500, with an average of $185 to $200. In most cases, the government pays for the first test. If the paint fails to meet specifications, the contractor pays for retesting the batch. Most posts report a very small rejection rate–about 2 to 5 percent. A few report a rejection rate of up to 10 percent, and one a rejection rate of 70 percent.

Many manufacturers will provide documents which certify that their paint conforms to Federal or military specifications. Often, however, this does not represent actual testing of the paint. This survey indicates that seven out of 10 posts accept nearly all of their paint on the basis of manufacturer certification. Some posts have had good results with this method. Certification provides documentation and possible recourse if the paint does not perform well. It is also faster than having paint tested by an independent lab. However, it does not always insure that the paint used is a quality product conforming to government specifications.

In summary, only a small percentage of the posts routinely test the paint they purchase, and even in cases where the paint is tested, results are not received until after the paint has been applied. Manufacturer's certification is a potential alternative to paint testing but without some quality assurance, certification does not always assure compliance with specifications.

Inspection

Although half of the respondents feel that there are enough inspectors to observe each phase of the painting operation (surface preparation, application of paint, and cleanup), seven out of 10 feel that there are not enough to allow for the proper inspection of all painting operations; i.e., there are generally more jobs than the inspectors can adequately handle.

An inspector must have practical experience and/or training in the inspection of painting operations, as well as the proper inspection equipment and the skill to use the equipment. Sixty percent of the posts report that most of their inspectors have paint inspection training or practical experience. The rest report that only a few of their inspectors have training or experience.

Nearly all the office chiefs and engineer/architects feel the inspectors attend to small details such as paint testing, thickness, number of coats, cleaning, workmanship, etc. Two said that the lack of adequate inspection equipment dictates visual determination of contract compliance. Some said they have too few inspectors or that the inspectors they have are poorly trained. Others cited specific problems with interpreting surface preparation and the number of coats applied. Many were satisfied that their inspectors strictly enforce specification and contract requirements.

An inspector should have the following basic equipment: (1) thickness measuring equipment, including wet and dry film gages, (2) a moisture meter, and (3) surface preparation standards. Other appropriate equipment may include a magnifying glass or microscope, mirrors, and a flashlight. This survey indicated that most inspectors do not have all of the equipment they need. Fewer than half have the appropriate paint thickness gages; slightly more than half have moisture meters.

The average inspector spends about 25 percent of his* time in the office. Nearly one-third of the respondents said that inspectors spend 70 to 80 percent of

*The male pronoun is used throughout this report to indicate both genders.

their time observing work at a specific site; however, they may have been indicating the total time spent on all field inspection. About 40 percent reported that the inspector spent 15 to 25 percent of his time at a specific site. This seems to be a more reasonable average.

Most of the office chiefs and engineer/architects believe that inspectors have enough power to do their jobs; however, most inspectors disagree. This may indicate either that the office chiefs and the engineer/architects are not fully aware of inspection difficulties or that the inspectors perceive their jobs differently.

About 30 percent of all respondents report that inspection emphasizes certain aspects of the painting operation. Surface preparation is most often emphasized; cleanup and final completion of the job are also stressed.

All three groups of respondents supported the idea of developing a field test kit which the inspector could use to run simple tests for detecting paint deficiencies. It would be used only as a screening device; it would not replace quality control measures such as lab testing.

Paint Problems and Repainting Schedules

The survey indicated that about half the repainting of buildings (both interior and exterior) is done on a routine schedule, and the other half as needed.

Peeling, cracking, or checking of paint was the most common major paint problem. This problem usually results from moisture or excessive buildup of paint layers. Exterior wood surfaces were most often the locations of frequent paint failures; exterior problems outnumbered interior problems by a ratio of 5 to 1. Oil-base paints were listed slightly more often than latex paints as the type of paint which failed most frequently.

Each respondent ranked the reasons for repainting. Table 2 summarizes the responses.

Overall, repainting schedules are split between routine repainting and repainting based on need. Eighty percent of the paint problems listed were associated with exterior painting. Peeling and cracking are the major exterior problems; peeling and dirty appearance are the major interior problems.

Protective Overlays as an Alternative to Painting

The use of protective overlays (aluminum, steel, or vinyl siding) on military installations has increased rapidly during the past few years. The long life, low maintenance, and energy e of siding make it a viable alternative to pai two-thirds of the posts surveyed, siding has been used on some structures instead of painting; others plan to use it soon. Most posts are using vinyl siding, but some have used aluminum or steel. Siding performance has been satisfactory and cost effective; however, most applications were less than 2 years old, so cost effectiveness over the entire life cycle has not yet been determined.

Table 2
Ranking of Reasons for Repainting
(List is in descending order of frequency.)

Exterior

1. Paint peeling
2. Paint cracking
3. No longer providing sufficient corrosion protection
4. Dirty appearance
5. Excessive chalking
6. Mildew growth and staining
7. Different color desired
8. Scheduled repainting cycle

Interior

1. Paint peeling
2. Dirty appearance
3. Paint cracking
4. Mildew growth and staining
5. Different color desired
6. Scheduled repainting cycle

A complete study of the life-cycle cost effectiveness of protective overlays has been published as ETN 78-7.[3] This publication can provide some useful background information for FE offices considering the use of protective overlays.

Although siding has many advantages, it is relatively expensive. It should not be used on temporary structures with a remaining life of only a few years. Vinyl siding will sometimes crack as it ages, and metal siding is subject to dents. Steel siding can rust if cut edges are not properly protected. When repairs are required, it may be hard to match the color and gloss of the new and old areas. Siding used to cover deteriorating wood can accelerate rotting, because moisture is trapped beneath it. However, despite these disadvantages, siding is a good choice for some applications.

[3] *Life Cycle Cost Study of Painting Existing Siding Versus Overlaying Existing Siding with Prefabricated Siding*, ETN 78-7 (Office of the Chief of Engineers, 6 February 1978).

Environmental Regulations

Responses to questions about environmental regulations indicate no particular problems. Only one-third of the respondents said that any regulations affected their painting operations. They are aware of regulations governing, for example, application of lead-based paints on family housing and playground equipment, exterior spraying of paint, and the disposal of waste paint and paint cans. Nearly all the respondents believe they have enough guidance for complying with the regulations.

4 SITE VISITS

CERL researchers visited six Army installations and interviewed personnel for this survey. Installation selection was based on several factors, including size, activity, and geographical location. As in the written survey, the persons interviewed were office chiefs, engineer/architects, and inspectors. The visits included a tour of the installation to observe painting problems. Although these interviews stated most of the views brought out by the questionnaires, the feelings expressed were often much more intense.

Materials

One subject discussed was the source of the paint used. Everyone was unhappy with the delivery time and quality of paints procured through GSA. For this and other reasons, all contracts specify contractor-furnished materials. There is definite controversy about whether these materials should be covered by Federal or military specifications or should be commercially available shelf products. Most people think that shelf products are of better quality than specification materials. This belief leads to rather unorthodox practices on some installations. At several installations where specification paints are routinely used, contracts call for brand-name paints for "critical" applications such as the Headquarters building and the commanding officer's residence. Some people think that Federal/military paint specifications are necessary to insure minimum quality of materials; others are so dissatisfied with the quality of specification materials that they either routinely draft their own specifications based on trade literature of shelf products, or they specify shelf products directly by brand name. When contracts call for a brand name "or equal," contractors often propose a less expensive products, knowing that it is usually hard to prove that a similar product is not equal with typical short-term tests.

For interior painting, several installations specifically condemned TT-P-29,[4] stating that proprietary products are much better. The main complaint was that it is impossible to remove soil without washing off all the paint. Personnel at several installations indicated that their paints had not actually been tested against the TT-P-29 specification; however, one indicated their paint source had been GSA. This post is now using an interior paint formulation based on a proprietary product which had performed satisfactorily. The TT-P-29 complaint raises many questions, ranging from the quality and use of the specification itself to GSA's quality control.

Interior Paint Problems

Interior painting did not pose major problems at most installations; however, some paint failures were observed at each site. Only one installation considered interior painting problems to be a major concern. The observed failures were generally attributed to moisture migration through the walls or to poor or nonexistent surface preparation and excessive paint buildup. The moisture migration was usually traceable to leaky windows, roofs, and gutters. In several cases, the efflorescence on concrete walls proved there had been a moisture problem for a long time. In other cases, the moisture had damaged plastered surfaces, making long-term performance of any future coatings impossible.

Some installations require using water-thinnable coatings on interior spaces. These latex paints are applied over existing gloss or semi-gloss enamels without appropriate surface preparation. This results in poor adhesion, which will destroy subsequent paint systems until either all of the paint is removed, or the wall is covered with a fabric or panel overlay.

Other interior problems include painting over electrical fixtures and staining caused by mildew. CEGS 09910 does not address the treating of mildewed surfaces, but RPMA does. Both specifications provide for protection of surfaces that are not to be painted, such as electrical fixtures. Thus, the problem occurred either because the guide specs were not followed or because the inspectors overlooked the deficiencies.

Geographic Location

An installation's geographic location affects its exterior paint problems. The aging World War II-era wooden structures all have an excessive accumulation

[4] *Federal Specification for Paint: Latex Base, Interior, Flat, White and Tints*, TT-P-29 (DA, August 1976).

of paint, which causes cracking and checking problems. These problems are very common in climates where high humidity and moisture may be trapped inside a building because of lack of ventilation. For example, on the California seacoast, high humidity and rain are common; however, the buildings in this area are always well ventilated so the aging paint is not affected. On the other hand, installations in high-humidity areas of the South and Southeast often close up buildings; this traps the moisture and leads to extensive paint failures.

Inspection

Inspection techniques differed among the various installations. The engineers all agreed they did not have enough personnel to provide the optimum level of inspection. On the other hand, the inspectors thought they did an excellent job of monitoring the contractors. One inspector, who was in charge of between five and 20 contractors at all times, stated that he "drove past every job every day."

The questionnaires indicated that most installations have some paint inspection equipment; however, discussions with inspectors revealed that generally the equipment is not used and, if it were used, its accuracy would be questionable. Therefore, inspectors usually take a more practical approach to their job. When one inspector was asked how he made sure the painter was using enough paint, he commented, "I tell the contractor to put it on to the sagging point." Observation of recently painted wooden buildings on this installation showed drips of paint hanging from the lower edge of almost every piece of siding.

Inspectors were typically more dissatisfied with contractor performance than were their superiors. They seemed to believe that the contractors might do anything to reduce their expenses or increase their profits. The inspectors related examples of excessive thinning of paint, omitting intermediate coats of a paint system, failure to do prescribed surface preparation, and inadequate cleanup. No attempt was made in this study to verify contract compliance; however, instances of unremoved overspray on windows and roofs and new paint applied over existing peeling paint were noted at several installations.

Protective Overlays

Vinyl, aluminum, or steel siding was observed on buildings at most of the installations and added to the structures' attractiveness. Sidings were used primarily to cover up paint problems. Everyone interviewed considered the siding performance to be satisfactory although no application was more than 4 years old.

However, the sidings observed were not without problems. Metal sidings were often dented or distorted by physical abuse. Areas where damaged sections had been replaced were sometimes obvious because of differences in gloss between the new and the weathered surfaces. One installation, which uses vinyl siding for the lower 6 ft (1.8 m) of many structures, has found that the vinyl is subject to cracking, especially in cold weather. Also, paint on doors and windows, which often are not covered with siding, is still subject to failure. In fact, installation of siding sometimes caused door and window areas to experience more intense moisture and rotting conditions.

Structure Preparation

The questionnaire did not cover one basic problem observed on most installations—that of adequately preparing a structure for a new coat of paint. It appears that when surface preparation is planned, only the treatment of the existing paint is considered. At several installations, it was obvious that the conditions which probably led to the previous paint failure had not been corrected before repainting. These conditions, which include cracked siding, rotted windowsills, damaged flashing, leaking roofs, and ineffective caulking, usually allow water to leak into the structure. In one residence, a leaking water pipe in a little-used area was responsible for continuing interior paint failures on the second and first floor walls; it also may have adversely affected the exterior paint. Unless such problems are corrected, paint performance will continue to be a problem. The Chiefs of Engineering Plans and Services and the specification writers said they were not usually aware of these deficiencies because they generally do not inspect a structure in detail before preparing a repainting contract.

The questionnaires were sent only to one MACOM; however, the site survey included visits to other Army facilities. The MACOM facilities that received the questionnaire do not normally use the RPMA guide specifications, but some of the other facilities included in the site surveys do use them. The site visits indicated that the RMPA specifications meet maintenance painting needs very well. However, installations which received questionnaires largely believe that RPMA is too complicated and that CEGS-09910 is not well suited for maintenance contracts.

No in-depth study was made of the benefits of using either type of guide specification; no obvious differences were noted in the painting operations at the respective installations.

5 RESEARCH NEEDS IDENTIFIED FROM SURVEYS

Perhaps the most universal complaint from all installations surveyed related to the use of Federal and military specification paints. Problems involving quality and availability were common. Many installations would prefer to use commercially available paints if they could be more easily specified. To meet this need, it is suggested that a paint selection guide handbook be developed.

A paint selection guide handbook should be oriented toward a materials selection (specification) procedure which allows use of the most appropriate paint (either a commercial off-the-shelf product or a government specification product). Heavy emphasis should be placed on developing performance specifications similar to those proposed by ASTM for eliminating the current practice of using complex formulation specifications. In addition, current guide specifications should be reviewed to determine adequacy and upgraded as needed to allow more open material specification.

To promote more effective use of inspectors, more refined techniques should be developed to assure compliance of painting contractors with specifications. On-site training aids should be developed for training the government's paint inspection personnel. The training aids should be compatible with existing facility training equipment and should emphasize quality assurance procedures versus conventional quality control inspection. A field paint test kit should also be developed. This kit should be a simple, low-skill procedure for real-time assurance that both the materials and application procedures comply with the contract specifications.

It is suggested that a paint maintenance management system be developed to optimize the use of available funds by scheduling painting on a priority-need basis. This system should interface with the other maintenance management systems being developed for the FE.

6 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

There are two major areas of dissatisfaction with material selection and guide specifications. First, the guide specs are restricted to Federal and military specification paints, which installation personnel think are inferior to brand-name products. Many prefer to use commercial products, even though there are no guidelines for them in the current specs.

Second, installation personnel feel that the guide specs do not apply well to all applications, especially to maintenance painting. One reason for this may be that they do not always use the most appropriate guide specs. Although CEGS-09910 on new construction is universally used, the RPMA guide spec on maintenance painting has only very limited use.

Use of in-house labor for painting is expected to decrease. Although the questionnaire results indicated that FE offices are reasonably satisfied with the work of paint contractors, personnel interviewed during the site visits expressed significant dissatisfaction with them.

The survey indicates that paint inspectors are generally trained adequately; however, there are not enough of them to insure proper quality control of every job. As a result, many inspectors must try to judge surface preparation and the number of coats applied after the job is done.

The paint used is often not tested, either because testing delays the work or because test results are meaningless since they are received after the painting is done. Therefore, many installations accept the manufacturer's certification that the product meets applicable specifications; accepting paint on this basis has sometimes been satisfactory.

Many premature paint failures are the result of insufficient structure and surface preparation. Sometimes, simple surface preparation is omitted (e.g., scuff sanding of the old glossy surface or thorough removal of cracked or peeling paints). However, the major problems are caused by roofs, gutters, and flashings that are not properly maintained; cracked siding boards; ineffective caulking; and rotted window sills. When repairs are attempted, the quality of materials and workmanship is sometimes not closely controlled. These types of repairs are expensive, but so are frequent repaintings and the effects of excessive paint buildup.

Many installations are using siding instead of repainting, and others plan to use it soon. Most reports rate siding performance as satisfactory and cost effective. However, most applications are less than 2 years

old, and cost effectiveness over the entire life cycle has not yet been determined.

Federal and State environmental regulations have caused few problems. The FE offices are aware of these regulations and have enough guidance to enforce them properly.

Several research needs were identified after analyzing the questionnaire and site survey results:

1. Development of a paint selection handbook.

2. Development of on-site training aids.

3. Development of a paint maintenance management system.

Development and implementation of these programs would decrease problems common to all installations in the areas of material selection, inspection, and scheduling painting needs.

Recommendations

The RPMA specification should be used for maintenance painting instead of CEGS-09910. This specification has a very useful checklist that will help the FE develop a maintenance painting contract.

The architects and engineers responsible for developing painting contracts should rely heavily on guidance in TM 5-618 and EM 1110-2-3400 for coating selection.

Work should be initiated on the suggested research needs as outlined in Chapter 5.

APPENDIX A:
CORRELATION OF PAINT FAILURES WITH ENVIRONMENTAL PARAMETERS

Post	# of WWII Structures	% Failure	Avg Annual Precipitation (inches)	Avg Temp °F	Avg Dewpoint °F	Relative Humidity %	Sulfur Oxide (tons/mi^2)
Fort Belvoir	424	23.11	36.49	56.5	43	67	13.221
Fort Benning	836	100.00	54.21	64.8	53	73	1.411
Fort Bliss	826	0.00	7.77	63.4	35	39	200.499
Fort Bragg	1158	5.18	46.69	61.3	51	72	5.393
Fort Campbell	699	100.00	48.20	57.3	47	69	1.038
Carlisle Barracks	33	0.00	38.00	53.2	42	67	5.966
Fort Carson	272	49.26	15.73	50.0	30	49	8.711
Fort Chaffee	1085	84.79	43.90	61.3	48	68	4.195
Detroit Arsenal	10	60.00	30.96	49.9	39	71	15.901
Fort Devens	593	20.07	41.44	48.7	37	67	81.157
Fort Dix	113	21.24	43.29	53.7	43	68	8.083
Fort Drum	222	0.00	39.20	45.9	37	73	3.054
Fort Eustis	195	61.54	43.76	58.5	48	72	68.423
Fort Gordon	370	100.00	42.63	63.4	52	72	48.288
Fort Harrison	72	100.00	38.74	52.3	43	73	368.873
Fort Hood	548	14.96	32.58	67.5	53	67	1.218
Fort Houston	178	10.67	26.58	69.7	56	67	13.371
Fort Indiantown Gap	1278	39.20	38.77	53.4	42	70	6.855
Fort Jackson	848	2.12	44.75	64.4	51	72	51.882
Fort Knox	1242	100.00	46.53	55.3	45	69	0.764
Fort Leavenworth	5	100.00	37.51	54.8	42	69	1.163
Fort Lee	378	94.97	42.12	58.0	47	72	87.152
Fort Lewis	208	100.00	45.14	50.1	40	74	61.619
Fort McClellan	125	100.00	52.83	61.1	50	71	3.409
Fort McCoy	1386	0.00	29.34	45.7	36	72	.395
Fort McPherson	108	78.70	48.34	60.8	49	70	22.987
Fort Meade	1100	47.00	41.96	55.2	43	67	44.393
Fort Monroe	34	0.00	46.99	59.8	50	71	58.377
Fort Ord	685	0.00	12.00	56.0	47	71	4.033
Fort Pickett	622	66.24	41.64	58.0	47	72	.269
Fort Polk	1341	31.32	54.35	66.3	57	74	.225
Redstone Arsenal	38	92.11	55.10	60.9	49	72	3.375
Fort Riley	66	0.00	32.00	55.1	41	68	.436
Fort Rucker	801	100.00	52.50	66.5	56	74	3.063
Presidio of San Francisco	33	0.00	20.66	56.7	47	75	118.883
Fort Shafter	67	0.00	35.16	76.6	63	67	--
Fort Sheridan	123	45.53	31.72	48.9	39	70	82.882
Fort Sill	427	18.27	30.18	62.3	45	60	.530
Fort Stewart	300	89.00	48.97	66.9	56	73	1.449
Fort Story	115	100.00	44.68	60.1	51	71	146.611
Fort Wood	925	100.00	41.00	57.0	45	71	.222

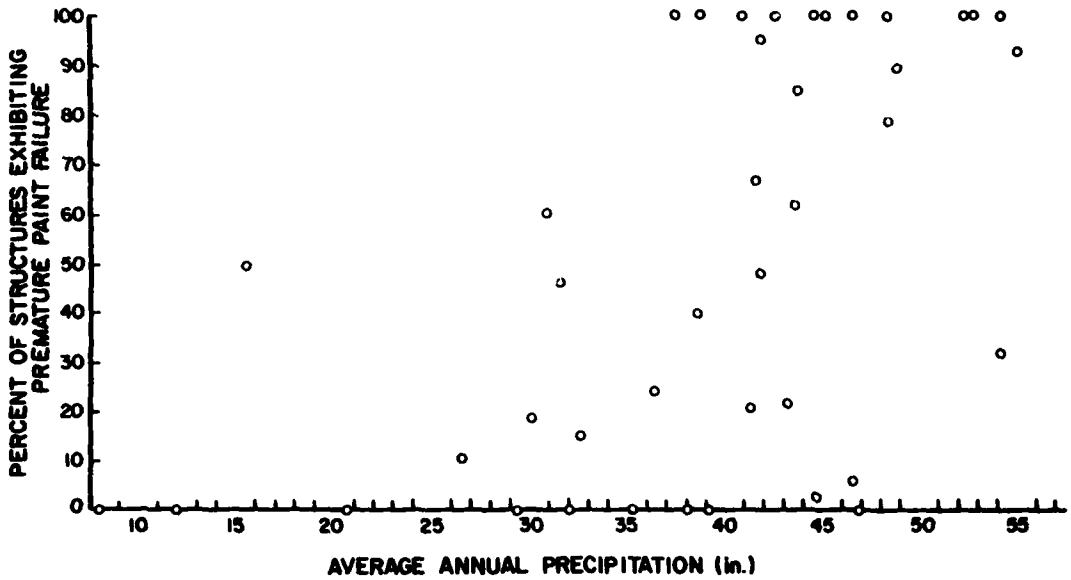

Figure A-1. Incidence of failure of World War II-type structures as a function of mean annual precipitation.

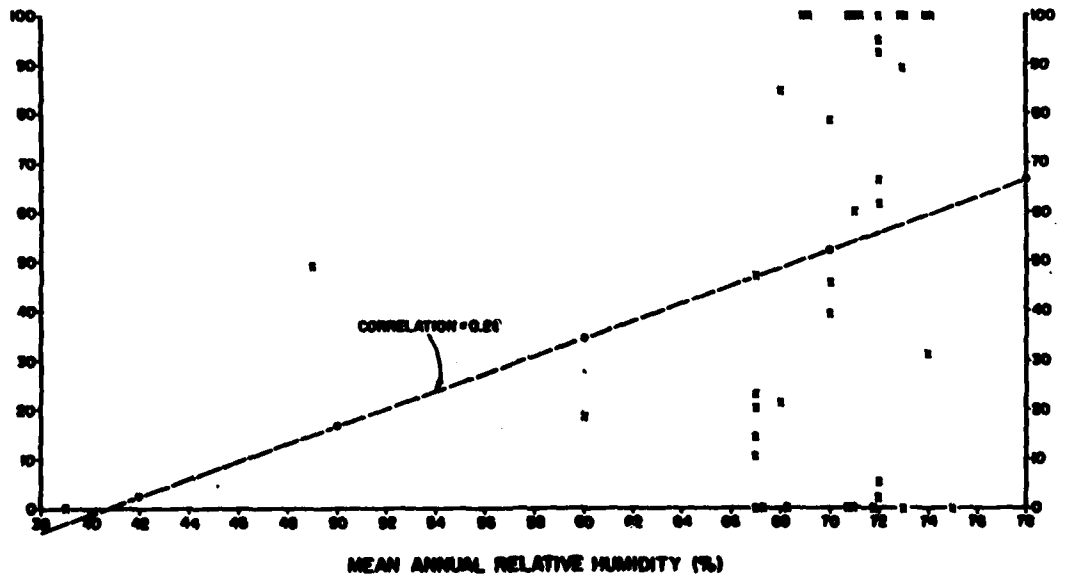

Figure A-2. Incidence of failure of World War II-type structures as a function of mean annual relative humidity.

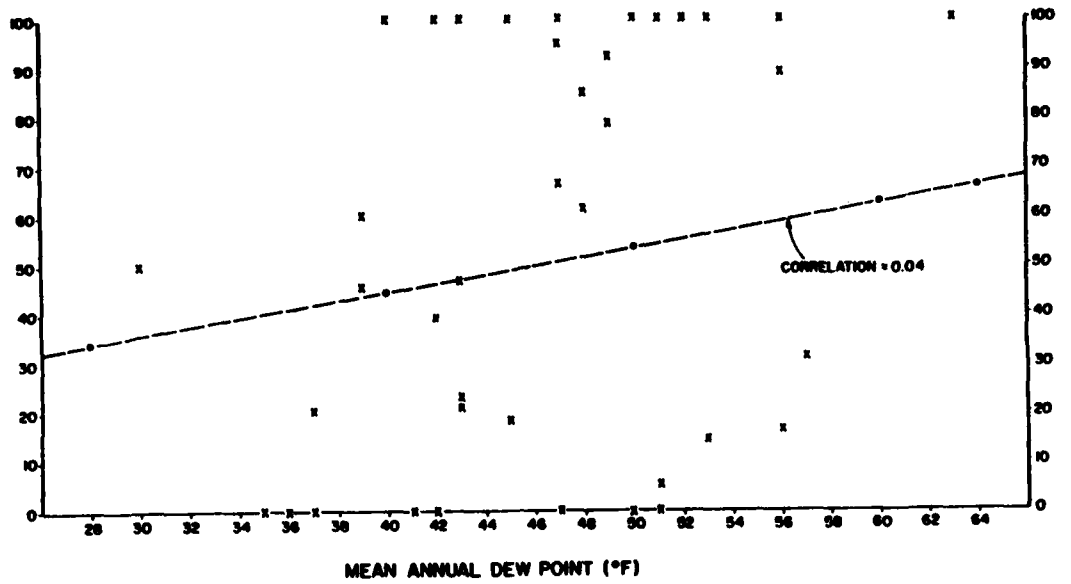

Figure A-3. Incidence of failure of World War II-type structures as a function of mean annual dew point temperature.

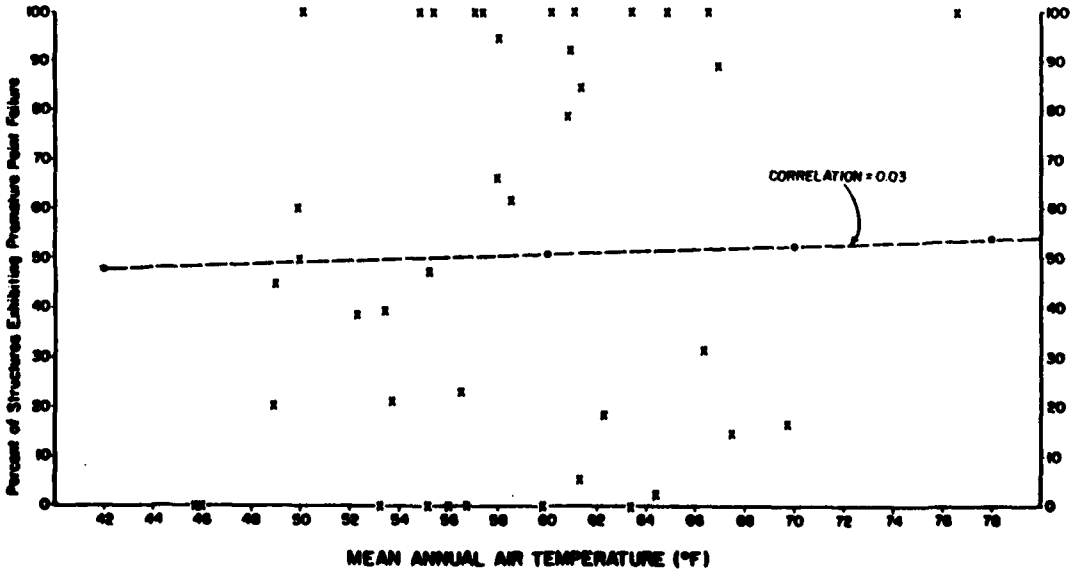

Figure A-4. Incidence of failure of World War II-type structures as a function of mean annual dry bulb temperature.

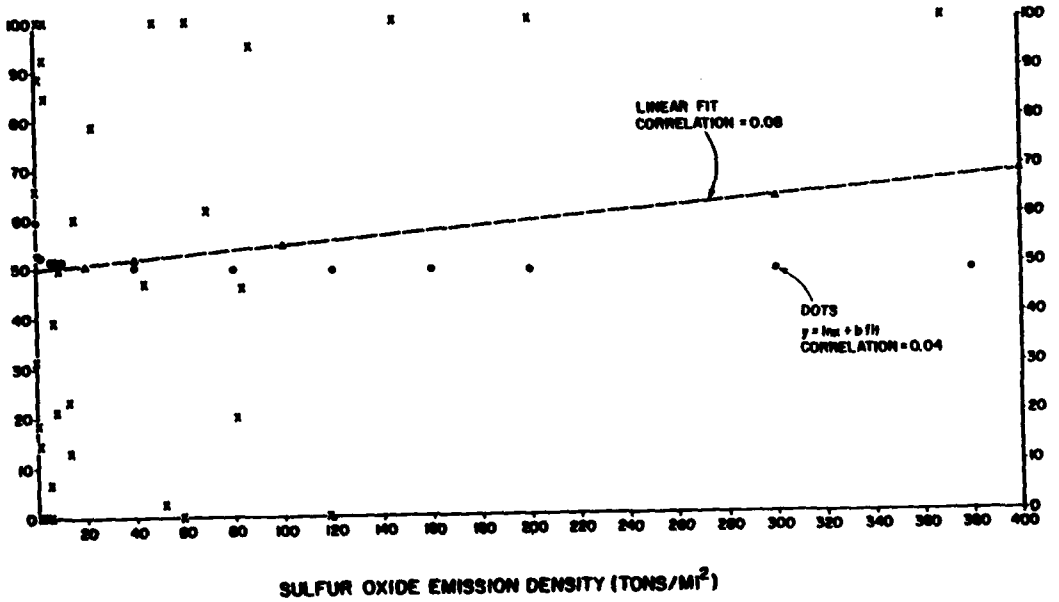

Figure A-5. Incidence of failure of World War II-type structures as a function of sulfur oxide emission density.

APPENDIX B:
SUMMARY OF QUESTIONNAIRE RESULTS

Paint Guide Specifications and Contracts

A. Do you have sufficient guidance to determine which paint or paint system to specify for a particular application?

	A	B
Yes	67	100
No	22	-0-
NR	11	-0-

10 persons commented

1 Prefer use of shelf paints
1 Need specs applicable in California
3 Guide specs lack information
1 Guides don't cover all applications
2 Guides not designed for M&R
2 Don't agree with guidance in guide specs

B. Are the guide specifications sufficiently effective to assure a quality paint job?

	A	B
Yes	67	80
No	22	20
NR	11	-0-

8 persons commented

3 CEGS-09910 can't be used exactly as written for M&R painting
1 Guide specs are poor
1 Commercial paints are better than spec. materials
1 CEGS-09910 is good for new construction
1 CEGS and RPMA suggested surface preparation often reduced due to lack of funds
2 CEGS is adequate to provide quality paint job
1 CEGS quality control of paint is not sufficient
1 CEGS cleanup requirements (e.g., paint spatters on new or existing) not strong enough

C. Are the guide specifications sufficiently strong to force compliance?

	A	B
Yes	56	90
No	22	10
NR	22	-0-

D. Are the guide specifications too complicated?

	A	B
Yes	11	40
No	72	60
NR	16.7	-0-

E. Do you have any suggestions for their improvement?

15 persons commented

2 Should use better grades of paint
2 Should not specify Fed. Spec. paints
2 Should use simpler (less technical) language
2 Should contain updates on QPL; and MIL Specs
1 Should be more performance oriented (e.g., contractor repaints if failure occurs in less than one year)
1 Should include new products on the market
1 Should increase quality of paint covered by Federal Specs
1 Develop a small version for small projects
1 Close legal loop-holes
1 Be more specific on surface preparation
1 Shorten RPMA

F. List the guide specifications concerning paint which you use.

9 persons commented

9 CEGS-09910
2 Previous Specs
1 Mfgr guide Specs
1 RPMA
1 CW-09940/EM-1110-2-3400

G. Are the guidespecs adequate and easy to use?

4 persons commented

2 The guidespecs are adequate
1 The guidespecs are easy to use
1 The guidespecs are adequate with some modification

H. Is any performance guarantee put into the contract for painting?

	A	B
Yes	56	60
No	33	30
NR	11	10

I. Do the contracting officers stand behind and enforce the contract and the guide spec requirements contained therein?

	A	B
Yes	78	80
No	6	-0-
NR	17	20

Governmental Regulations

A. Are any air pollution and/or other environment regulations in effect in your locality which affect painting operations at your facility?

	A	B
Yes	28	20
No	56	50
NR	17	30

1. Specify the type of regulations and the effects they have on painting operations.

6 persons commented

3 Exterior spraying
1 Lead paints on playground equipment
1 All OSHA and EPA regulations
1 Disposal of paint cans in landfill
1 No oil based enamels (CARB requirements)

2. Have you found that there is sufficient guidance available to cope with these regulations?

	A	B
Yes	28	40
No	6	-0-
NR	67	60

3. Do you have to use alternate paints, that is, paints not listed by the guide specifications or manuals, due to environmental regulations?

	A	B
Yes	-0-	-0-
No	39	50
NR	61	50

Contractors

A. Would you consider most of the painting contractors you have dealt with to be reputable?

	A	B	C
Yes	72	50	78
No	11	20	22
NR	17	30	-0-

B. Do most of the paint contractors try to do a good job or "just get by"?

	A	B	C
Try to do good job?	61	50	72
Just get by?	22	20	28
NR	17	30	-0-

C. Do the contractors have adequate surface preparation and application equipment to do a proper job?

	A	B	C
Yes	67	60	83
No	11	-0-	17
NR	22	40	-0-

D. Is surface preparation done in complete compliance with contract requirements?

	B	C
Yes	40	72
No	10	28
NR	50	-0-

E. Are there problems with mixing the thinning of the paints (such as no mixing or excessive thinning)?

	B	C
Yes	-0-	28
No	50	72
NR	50	-0-

5 persons commented

3 Painters often over thin their paints sometimes after the inspector has left the job site
2 Mixing problems occur especially if paints have been stored too long

F. Are coats applied too thin or omitted completely?

	B	C
Yes	10	39
No	40	61
NR	50	-0-

How is this determined?

8 persons commented

4 By observation
3 At final inspection of the job
1 Paint usually applied too thick

G. Is satisfactory cleanup (rubbish removal, windows, floors cleaned, etc.) accomplished before the contractor leaves?

	B	C
Yes	60	94
No	-0-	6
NR	40	-0-

H. Do the contractors use sufficient protective measures, i.e., masking tapes, tarps, vinyl covers, etc.?

	B	C
Yes	60	83
No	-0-	17
NR	40	-0-

Are these specified in the contract?

	B	C
Yes	50	89
No	10	11
NR	40	-0-

In-House Painting

A. Do you have any painters as permanent government employees?

	A	B
Yes	78	50
No	22	10
NR	-0-	40

1. If so, how many?

14 persons commented

1	No painters
4	2 painters
2	3 painters
2	6 painters
2	7 painters
1	9 painters
1	17 painters
1	50 painters

2. What criteria is used to determine whether in-house or out-of-house personnel are used for a given painting operation?

19 persons commented

6	Workload
4	Time required for job completion
3	Cost of project
10	Size of project
2	Priority of job

Materials

A. Are most of the paints used at your facilities contractor or Government supplied?

	A	B	C
Contractor	89	20	89
Government	6	40	11
NR	6	40	-0-

1. What is percentage of contractor supplied paints?

36 persons commented

#	%
1	0
2	25
2	50
2	75-80
6	90-95
23	98-100

2. Would you prefer opposite of the above?

	A	B	C
Yes	17	10	28
No	72	50	72
NR	11	40	-0-

17 persons commented

3	Government paint is better quality
6	Government paint is poorer quality
1	No storage space for Government furnished paint
1	Government specs don't cover specialized coatings
4	Contract runs more efficiently if contractor supplies paint
1	GSA delivery time is poor
1	Can obtain large quantities of GSA paints pre-tested
1	No guarantee with GSA paints

B. Do you use any off-the-shelf proprietary product paints?

	A	B	C
Yes	39	40	50
No	50	20	44
NR	11	40	6

1. Is the quality of these off-the-shelf paints as expected?

	A	B	C
Yes	44	50	72
No	-0-	-0-	28
NR	56	50	-0-

2. How do you specify what you want?

9 persons commented

4 By brand name or equal
3 By Federal Spec number
2 Develop technical provisions from manufacturer data sheets and put into contract

C. Do you procure Government spec paints from GSA?

	A	B	C
Yes	33	20	11
No	50	30	67
NR	17	50	22

1. Do they (GSA) provide timely delivery?

	A	B
Yes	6	20
No	11	-0-
NR	83	80

2. Is the condition of the paint acceptable?

	A	B	C
Yes	6	20	6
No	17	-0-	6
NR	78	80	89

3. Do you have this paint tested?

	A	B	C
Yes	-0-	-0-	-0-
No	17	20	6
NR	83	80	94

4. Do the GSA procured paints perform as expected?

	A	B	C
Yes	11	20	-0-
No	17	10	11
NR	72	70	89

D. Do you obtain Government spec paints through local procurement?

	A	B
Yes	56	40
No	33	20
NR	11	40

1. Do you find paints needed are easily obtained?

	A	B
Yes	72	50
No	-0-	-0-
NR	28	50

2. Is the condition of the paint acceptable?

	A	B
Yes	72	50
No	-0-	-0-
NR	28	50

3. Do the paints procured in this manner meet expectations?

	A	B
Yes	67	30
No	6	20
NR	28	50

E. Do you have any of your paints tested by a laboratory to check on quality and conformance to the specifications?

	A	B	C
Yes	83	50	72
No	11	10	28
NR	6	40	-0-

1. Is a government or private laboratory used for testing?

	A	B	C
Government	39	50	56
Private	17	10	17
NR	44	40	28

2. What is the cost of the testing?

19 persons responded

5 $50-$125
8 $150-$200
3 $275-$350
3 $500 or more

3. Who pays for the testing costs--the Government or the contractor?

	A	B	C
Government	67	40	72
Contractor	-0-	-0-	6
NR	33	60	22

10 persons commented

9 Government pays for first test; contractor pays for retest
1 Testing service is slow

F. Approximately what percentage of all paint materials used are laboratory tested?

29 persons responded

#	% tested
6	0-1%
11	4-10%
2	20-25%
3	50-75%
7	90-100%

1. Of those paints tested, what is the percentage rejected vs. the percentage approved?

27 persons responded

#	% rejected
12	0-2%
9	4-5%
4	10%
2	70%

2. What criteria is used for having a paint tested?

30 persons responded

16 Guide specification requirements
2 Random sample
7 Reputation of manufacturer or contractor
5 Poor appearance of paint
1 Critical applications

3. Are test results received promptly enough to normally be worthwhile?

	A	B	C
Yes	44	40	56
No	33	10	33
NR	22	50	11

a. What is a typical time frame between receipt of the paint on the job site until the paint application is actually started?

31 people responded

#	Weeks
19	1 week or less
4	2 weeks
4	4-8 weeks
4	Over 8 weeks

b. Of samples tested, what percentage are already applied prior to receipt of test results?

27 people responded

#	% applied
3	0-1%
9	5-15%
5	20-50%
5	80-90%
5	100%

G. Do typical contractors tend to hinder the taking of paint samples at the job site?

	A	B	C
Yes	-0-	-0-	-0-
No	67	50	78
NR	33	50	22

H. Other than for small quantities, do you accept certification of paint specification compliance and performance?

	A	B	C
Yes	56	30	83
No	28	30	11
NR	17	40	6

1. What percentage is accepted in this manner?

23 persons responded

#	% accepted
1	2%
1	20%
1	50%
4	75-80%
16	90-100%

2. What criteria is used for accepting paint in this manner?

18 persons responded

13 Manufacturers reputation
1 Weight of container
5 Specification limit of 25 gal or less

3. Is certification of paints a worthwhile practice?

	A	B	C
Yes	72	40	78
No	11	20	6
NR	17	40	17

13 persons commented

5 Certification forces contractor quality control
1 Follow-up testing has verified certification
1 Testing takes too long
1 Saves time and provides required documents
4 Have had good success with certification
3 Can't trust certification

I. Have there been any problems concerning the use of off-the-shelf paints?

	A	B	C
Yes	11	10	22
No	61	40	61
NR	28	50	17

7 persons commented

3 Hard to justify sole source procurement
1 Hard to prove "or equal"
4 Have had some problems

1. Does the paint perform as anticipated?

	A	B	C
Yes	67	50	67
No	-0-	-0-	6
NR	33	50	28

Inspection

A. Do the inspectors or other responsible officials give attention to small details, i.e., paint testing, thickness, number of coats, cleanup, workmanship, etc.?

	A	B
Yes	83	70
No	-0-	10
NR	17	20

12 persons commented

2 Lack of adequate equipment dictates visual inspection
1 Insufficient number of inspectors
1 Poorly trained inspectors
1 Difficult to interpret surface preparation
1 Hard to check number of coats
1 Difficult to enforce workmanship
1 Cleanup is a problem
5 Inspectors strictly enforce spec requirements

B. Is there a Government inspector to provide inspection of the entire painting operation?

	A	B	C
Yes	39	30	67
No	56	20	33
NR	6	50	-0-

1. Are there enough inspectors to properly inspect all painting operations or are there generally more jobs going on than the inspectors can handle?

	A	B	C
Enough inspectors	17	30	22
Not enough	72	20	72
NR	11	50	6

2. Have the paint inspectors had any paint inspection training or, at least, practical painting experience of the kind being performed?

	A	B	C
Most have	61	10	67
Some have	17	30	22
Few have	17	10	6
None have	-0-	-0-	6
NR	6	50	-0-

3. Do the paint inspectors have other inspection duties also?

	A	B	C
Yes	94	50	100
No	-0-	-0-	-0-
NR	6	50	-0-

4. Do the paint inspectors have appropriate equipment to do their jobs?

	A	B	C
Yes	39	50	33
No	33	-0-	50
NR	28	50	17

List this equipment.

21 persons commented

10	Wet film thickness gauge
10	Dry film thickness gauge
13	Moisture meter
3	Mirrors
1	Micrometers
2	Microscope
1	Color chips
2	Bird-dog tester
1	Breathing device
1	Brooms
2	Trucks
1	Sample cans
1	Test kits
1	Step ladder

C. What percentage of the inspector's time (on a daily basis) is spent observing the work being performed on the site of a specific painting operation?

32 persons responded

6	10% or less
12	15%-25%
4	35%-50%
10	70%-80%

D. What percentage of the inspector's time (on a daily basis) is spent in the office?

35 persons responded

11	15% or less
22	20% to 30%
1	50%
1	75%

E. Does the inspector have sufficient power to properly do his/her job?

	A	B	C
Yes	56	40	44
No	28	20	50
NR	17	40	6

F. Are all aspects of the painting operation (surface prep, application, finishing touches, final completion) inspected equally or are certain aspects emphasized?

	A	B	C
Equal inspection	44	20	44
Certain aspects emphasized	33	30	39
NR	22	50	17

Which are emphasized?

21 persons commented

16	Surface preparation
7	Final completion
2	Cleanup

G. If an easy-to-use field paint test kit were available to provide on the job site detection of possible paint deficiencies, would it be used? (The kit would be used as a screening device. Paints indicating major deficiencies would require complete laboratory testing.)

	A	B	C
Yes	89	60	94
No	-0-	-0-	6
NR	11	40	-0-

7 persons commented

6	Test kit is a good idea
1	Test kit is not necessary

Protective Overlays (Siding)

A. Have protective overlays or siding (vinyl, aluminum or steel) been used in lieu of painting?

	A	B
Yes	67	40
No	33	30
NR	-0-	30

If so, why?

9 persons commented

1	Not approved by TRADOC
1	Aluminum has not been proven cost effective
1	None are cost effective
3	Not used now but plan to use in future
1	Steel is more feasible when repainting
2	Have found them to be cost effective
1	Began using sidings because of continuing paint problems

1. What types of sidings have been used?

16 persons commented

11 Vinyl
5 Steel
4 Aluminum

2. How old are the oldest applications?

9 persons commented

1 Less than 1 yr
5 1 yr
1 3 yr
2 4 yr

3. Has the performance been satisfactory?

	A	B
Yes	56	30
No	44	-0-
NR	-0-	70

4. What criteria determines the use of siding?

12 persons commented

8 Sidings are cost effective
3 Had history of paint problems
1 Existing wood siding in poor condition
1 Energy savings

5. Has the use of the siding material proved to be cost-effective?

	A	B
Yes	61	20
No	39	-0-
NR	-0-	80

Paint Problems and Repainting Schedules

A. Is most exterior painting done as needed or on a routine repainting cycle?

	A	B	C
As needed	61	20	44
Routine cycle	28	40	39
NR	11	40	17

How about interior painting?

	A	B	C
As needed	67	20	39
Routine cycle	22	40	50
NR	11	40	11

B. What would you say is the most frequent paint failure at your post?

27 persons responded

15 Paint peeling, cracking or checking
9 Exterior paint on wood
3 Peeling and loss of adhesion due to moisture

1. Location of failure?

27 persons responded

14 Exterior wood
6 Exterior surfaces
2 Trim
2 Complete buildings
4 Interior walls
2 Metal buildings
2 Block structures
1 Interior heavy use areas

2. Type of paint(s) involved?

24 persons responded

16 Oil base
13 Latex
1 Fed. Spec. paints
1 All Fed. Spec. Latex
1 Shop applied metal coatings

Final Comments

Chief of Engineering Plans and Services,

"Specifications should be developed to use top line brand name paint instead of Fed. Spec. paint."

"More inspectors would help more than anything."

"We will take all of the information and help you give us. Would like to have 4 paint kits or tell us where we can order."

Paint Inspectors,

"I think that all wood siding buildings should have aluminum/metal masonite exterior siding installed and under guarantee for 15-40 years. This would save a lot of cost in painting and repainting."

"Eight years ago in 1973 and previous years inspection was lax. Also in the 60's and 70's coating manu-

facturers were pushing water borne materials. The exterior here on post had been painted since time began with oil based materials. All at once water borne materials were used over these surfaces without the necessary preparation. Proper primers were not used if any at all. The result combined with weather conditions (wet/damp) began a peeling cracking condition that is almost impossible to check. At the same time oil was applied over latex on the interior and along with subsurface failure and a moisture condition interior paints cracked, peeled, and came off all the way to the plastered surface. Upon examination these surfaces were found to be heavily chalked. Paint removal all the way to the plaster is both difficult and terribly expensive. So there we stand. We end up with a piecemeal situation. Trying desperately to solve our problems with more coats of paint. All we are ending up with is one massive paint buildup."

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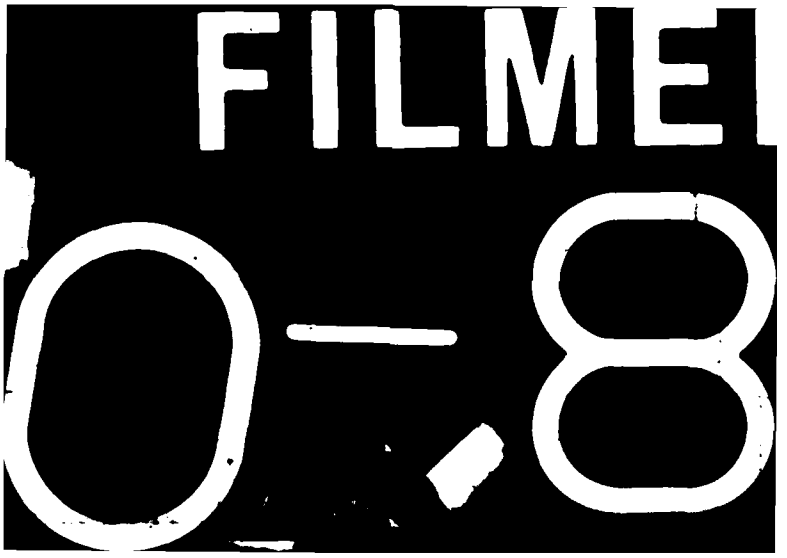
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